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TITLE: METHOD AND SYSTEM FOR OPERATING A DEGRADED VEHICLE COMMUNICATION UNIT

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METHOD AND SYSTEM FOR OPERATING A DEGRADED VEHICLE COMMUNICATION UNIT

FIELD OF THE INVENTION

In general, the invention relates to Global Positioning System (GPS) transmissions as well as data transmission over a wireless communication system. More specifically, the invention relates to a method and system for operating a degraded in-vehicle communication unit within a mobile vehicle communication system.

BACKGROUND OF THE INVENTION

Mobile communication units (MCU's), such as cellular phones, personal data assistants (PDA's), and on-board Vehicle Communication Units (VCU's), used in conjunction with a Wide Area Network (WAN), such as a cellular telephone network or a satellite communication system, have made it possible for a person to send and receive voice communications, data transmissions, and FAX messages from virtually anywhere on earth. Such communication is initiated at the MCU when it is turned on, or by entering a phone number to be called, or in many cases, by pressing a preprogrammed button on the MCU or speaking a voice command causing the MCU to automatically complete the process of dialing the number to be called. A radio communication link is established between the MCU and a Wide Area Network (WAN), using a node of the WAN in the vicinity of the MCU.

Once the radio communication link between the MCU and the cellular base station has been established, the base station then utilizes a combination of additional cellular stations, conventional telephone wire line networks, and possibly even satellite systems to connect the MCU to the number to be called.

Wireless communication services for MCU users, such as navigation and roadside assistance that utilize GPS, have increased rapidly in recent years. Most of the services that have been offered are for a motor vehicle in operation, and include services that may require location and destination information, usually provided utilizing GPS data.

Examples of roadside assistance that utilize GPS, in addition to other wireless communication services, include providing location information in emergency situations, such as, for example automobile accidents, medical emergencies, and automobile theft. Unfortunately, in many instances of the above examples one or more critical portions, such as, for example the antenna portion or the power supply portion, of the MCU may be degraded. In the event of an automobile accident scenario, the degradation may be unintentional as opposed to an intentional degradation in the event of an automobile theft scenario.

It would be desirable, therefore, to provide a method and system that would overcome these and other disadvantages.

SUMMARY OF THE INVENTION

One aspect of the invention includes a method for operating a vehicle communication unit within a mobile vehicle communication system. The method includes determining a primary communication mode failure, initiating a secondary communication mode responsive to the primary communication mode failure determination, and operating a telematics device in the secondary communication mode within the vehicle communication unit.

In accordance with another aspect of the invention, a computer readable medium storing a computer program includes: computer readable code for determining a primary communication mode failure; computer readable code for initiating a secondary communication mode responsive to the primary communication mode failure determination; and computer readable code for operating a telematics device in the secondary communication mode within a vehicle communication unit.

In accordance with yet another aspect of the invention, a system for operating a vehicle communication unit within a mobile vehicle communication system is provided. The system includes means for determining a primary communication mode failure. Means for initiating a secondary communication mode responsive to the primary communication mode failure determination is provided. Means for operating a telematics device in the secondary communication mode within the vehicle communication unit is also provided.

The foregoing and other features and advantages of the invention will become further apparent from the following detailed description of the presently preferred embodiment, read in conjunction with the accompanying drawings. The detailed description and drawings are merely illustrative of the invention rather than limiting, the scope of the invention being defined by the appended claims and equivalents thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram illustrating an operating environment according to an embodiment of the present invention;

FIG. 2 is a block diagram illustrating an embodiment of a system for operating a degraded telematics unit, in accordance with the present invention; and

FIG. 3 is a flow diagram depicting an exemplary embodiment of a method of operating a degraded telematics unit, in accordance with the current invention.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram illustrating an example of an operating environment that is in accordance with the present invention. **FIG. 1** details an embodiment of a system for operating a global positioning service and a wireless communication service in a mobile vehicle, in accordance with the present invention, and may be referred to as a mobile vehicle communication system (MVCS) **100**. The mobile vehicle communication system (MVCS) **100** includes one or more mobile vehicle communication units (MVCU) **110**, one or more wireless communication systems **120**, one or more GPS satellite broadcast systems **140**, one or more communication networks **150**, one or more land networks **160**, and one or more service providers **170**. MVCU **110** includes telematics device **115** and global positioning system (GPS) unit **117** as well as additional components not relevant to the present discussion. MVCS **100** may include additional components not relevant to the present discussion.

In one example, MVCS **100** is implemented as an OnStar system, as is known in the art, with regards to wireless communications, and as a GPS system, as is known in the art, with regards to satellite and radio GPS communications. MCVU **110** may also be referred to as a mobile vehicle throughout the discussion below. In operation, MCVU **110** may be implemented as a motor vehicle, a marine vehicle, or as an aircraft.

Telematics unit **115** is a wireless vehicle communication device/module that includes an analog or digital phone with suitable hardware and software for transmitting and receiving data communications. In operation, telematics unit **115**, within MCVU **110**, sends to and receives radio transmissions from wireless communication system **120**.

In one embodiment, telematics unit **115** further includes a wireless modem for transmitting and receiving data. In another embodiment, telematics unit **115** includes a digital signal processor with software and additional hardware to enable communications between the mobile vehicle and MVCS **100**, and to perform other routine and requested services.

Additionally, MCVU **110** includes global positioning system (GPS) unit **117** that receives broadcasts from GPS satellite broadcast system **140**. GPS unit **117** is capable of determining synchronized time and a geophysical location of the mobile vehicle based on the received broadcasts. In other embodiments, one or more of the above described components, such as, for example the wireless modem are implemented as independent components that are interfaced with telematics unit **115** to provide necessary functionality. In yet another embodiment, one or more of the above described components, such as, for example GPS unit **117** are implemented as integrated components within telematics unit **115** to provide necessary functionality.

Telematics unit **115** and GPS unit **117** include hardware suitable for receiving broadcast signals within MCVU **110**. In one embodiment, telematics unit **115** includes a receiver that receives broadcasts from wireless communication system **120** and GPS unit **117** includes a GPS receiver that receives GPS broadcasts from GPS satellite broadcast system **140**.

In another embodiment, telematics unit **115** and GPS unit **117** further include a medium for storing programming information. In an example, the programming information includes provider supplied programs. Supplied programs may include such programs as GPS reception, navigation, diagnostic, and the like.

In another embodiment, MCVU **110** includes an automatic speech recognition system (ASR) module capable of communicating with telematics unit **115**. In yet another embodiment, the module is capable of functioning as any part or all of the above communication devices and, for another embodiment of the invention, may be capable of data storage, and/or data retrieval, and/or receiving, processing, and transmitting data queries. In one example, MVCS device **115** includes an ASR module.

Wireless communications system **120** is a wireless communications carrier or a mobile telephone system and transmits to and receives signals from one or more MCVU **110**. Wireless communication system **120** incorporates any type of telecommunications in which electromagnetic waves carry signal over part of or the entire communication path. In one embodiment, wireless communication system **120** is implemented as any type of broadcast communication in addition to GPS satellite broadcast system **140**.

In one example, such wireless communication system **120** is a short message service, modeled after established protocols such as IS-637 SMS standards, IS-136 air interface standards for SMS, and GSM 03.40 and 09.02 standards. Similar to paging, an SMS communication could be broadcast to a number of regional recipients. In another embodiment, the wireless communication system **120** operates using a Dedicated Short Range Communication (DSRC) standard.

In another example, the mobile telephone system may be an analog mobile telephone system operating over a prescribed band nominally at 800 MHz. The mobile telephone system may be a digital mobile telephone system operating over a prescribed band nominally at 800 MHz, 900 MHz, 1900 MHz, or any suitable band capable of carrying mobile communications.

GPS satellite broadcast system **140** transmits radio signals to GPS unit **117** within MCVU **110**. In one embodiment, GPS satellite broadcast system **140** may broadcast over a spectrum in the "L" band (1.575 GHz) that has been allocated by the U.S. Federal Communications Commission (FCC) for nationwide broadcasting of GPS satellite-based services. In an example, GPS satellite broadcast system **140** may be implemented as a global positioning service (GPS). In operation, broadcast services provided by GPS satellite broadcast system **140** are received by GPS unit **117** located within MCVU **110**.

Communications network **150** is implemented as any suitable system or collection of systems for connecting wireless communications system **120** to at least one MCVU **110** or to a service provider **170**. In one embodiment,

communications network **150** includes a mobile switching center and provides services from one or more wireless communications companies.

Land network **160** connects communications network **150** to service provider **170**. In one embodiment, land network **160** is implemented as a public-switched telephone network, a wired network, an optical network, a fiber network, another wireless network, or any combination thereof. In an example, land network **160** includes an Internet protocol (IP) network. In another embodiment, an MCVU **160** utilizes all or part of the wireless communications system **120**, communications network **150**, and land network **160**.

In yet another embodiment, land network **160** connects one or more communications systems **120** to one another. In another embodiment, communication network **150** and land network **160** connect wireless communications system **120** to a communication node or service provider **170**.

Service provider **170** is implemented as one or more locations where communications may be received or originate to facilitate functioning of the mobile vehicle communication system (MCVS) **100**. Service provider **170** may contain any of the previously described functions.

In one embodiment, service provider **170** is implemented as a call center, as known in the art. In an example, the call center is implemented as a voice call center, providing verbal communications between an advisor in the call center and a subscriber in a mobile vehicle. In another example, the call center is implemented as a voice activated call center, providing verbal communications between an ASR unit and a subscriber in a mobile vehicle. In yet another example, the call center is implemented as a virtual call center, providing virtual communications between a virtual advisor and a user interface. In another embodiment, the call center contains any of the previously described functions.

In an example, the call center is implemented to service an OnStar system. In yet another example, the call center is implemented to service one or more of the above examples, or other services.

In operation, a service provider **170** utilizes one or more portions of the aforementioned communications network to communicate GPS data and service provider programming to telematics unit **115** and GPS unit **117**. The provider programming may then be utilized by telematics unit **115** and GPS unit **117** to implement the present invention.

FIG. 2 is a block diagram illustrating an embodiment of a system for operating a degraded vehicle communication unit. Mobile vehicle communication system (MVCS) **200** includes GPS satellite broadcast system **140**, mobile vehicles (**210**, **211**), one or more wireless carrier systems **240**, and one or more call centers **270**. In one embodiment, MVCS **200** may include additional components not relevant to the present discussion. Elements in **FIG. 2** that are numbered identically to elements in **FIG. 1** function in a substantially similar way.

In accordance with the present invention, each mobile vehicle (**210**, **211**) is a vehicle communication unit includes a telematics unit (not shown) and a GPS unit (not shown) as described in **FIG. 1**, above. The telematics units includes hardware and software to operate in a primary communication mode, such as, for example the short message service, analog mobile telephone system, or digital mobile telephone system described in **FIG. 1**, above. The GPS unit includes hardware and software to receive GPS satellite broadcast as described in **FIG. 1**, above.

The telematics units within mobile vehicles (**210**, **211**) further include hardware and software to implement additional wireless communication capabilities as defined by the U.S. Federal Communications Commission (FCC) in FCC Part 15 rules (47 CFR §15), such as, for example short range wireless technology or wireless networking technology. In one embodiment, each mobile vehicle (**210**, **211**) within MVCS **200** is a node of a mobile ad hoc network (MANET), as is known in the art. The additional wireless communication capability is called a secondary communication mode. Operation in the

secondary communication mode allows the telematics unit within one mobile vehicle to communicate, over short distances and utilizing significantly less power, with other mobile vehicles equipped with similar capabilities.

In an example, the telematics units within mobile vehicles (**210**, **211**) further include hardware and software to implement the secondary communication mode that includes a short range wireless technology, such as, the Bluetooth standard, that uses a frequency of 2.45 gigahertz (GHz), established by international agreement for industrial, scientific, and medical devices (ISM) utilization as well as consumer utilization.

In another example, the telematics units within mobile vehicles (**210**, **211**) further include hardware and software to implement the secondary communication mode that includes a wireless networking technology, such as, wireless Wide Area Network (WAN) technology and wireless Local Area Network (LAN) technology that is based on the Institute of Electronic and Electrical Engineers (IEEE) 802.11 series standard.

Mobile vehicle **210** represents a mobile vehicle within MVCS **200** having a fully functional telematics unit (not shown) that is able to communicate with wireless carrier system **240** as well as a fully functional GPS unit that is able to receive GPS satellite broadcast from GPS satellite broadcast system **140**. The fully functional telematics unit within mobile vehicle **210** is able to operate in both the primary communication mode as well as the secondary communication mode.

In one embodiment, mobile vehicle **211** represents a mobile vehicle within MVCS **200** having a degraded telematics unit (not shown) that is not able to communicate with wireless carrier system **240**. The degraded telematics unit within mobile vehicle **211** is unable to operate in the primary communication mode. The degraded telematics unit within mobile vehicle **211** is able to operate in the secondary communication mode. Examples of degradation of the telematics unit include degradation of one or more critical portions of the

telematics unit, such as the antenna portion or the power supply portion of the telematics unit or the mobile vehicle. Scenarios of degradation of the primary communication mode include an automobile accident, vehicle theft, and the like. In the event of an automobile accident scenario, the degradation may be unintentional as opposed to an intentional degradation in the event of an automobile theft scenario.

In another example, a degraded telematics unit includes a telematics unit that is not equipped or designed to operate in the primary communication mode. In this example, the degraded telematics unit within mobile vehicle **211** is able to operate in the secondary communication mode, such as the 802.11 series standard or the Bluetooth standard described above. Note that in this example, the telematics unit is not degraded in the customary understanding of the word "degraded" but is rather "degraded" in that the primary communication mode is not enabled for the unit. Thus, in this application the word "degraded" and its derivatives is defined broadly and includes both telematics units that do not function as intended, and telematics unit that do not have the ability to communicate in the primary communication mode described herein.

In another embodiment, mobile vehicle **211** represents a mobile vehicle within MVCS **200** having a degraded GPS unit (not shown) that is unable to receive GPS satellite broadcast from GPS satellite broadcast system **140**. In this embodiment, the GPS unit within mobile vehicle **211** may or may not be able to operate in the primary communication mode. Reasons for degradation of the GPS unit include degradation of one or more critical portions of the GPS unit, such as, for example the antenna portion or the power supply portion of the GPS unit or the mobile vehicle. This degradation may result from intentional or unintentional misuse, or other factors beyond control, such as weather.

In operation, upon determination of a primary communication mode failure, the telematics unit within mobile vehicle **211** initiates the secondary communication mode. In one embodiment, determination of the primary communication mode failure occurs when the telematics unit within mobile vehicle **211** can not initiate contact or maintain communication with the wireless carrier system **240**. In another embodiment the telematics unit does not include the necessary hardware and software to initiate contact or maintain communication with the wireless carrier system **240**, and in this embodiment, the determination of the primary communication mode failure is preordained as the telematics unit does not have the capability to operate in the primary communication mode defined herein. In another embodiment, determination of the primary communication mode failure occurs when the GPS unit within mobile vehicle **211** is unable to receive GPS satellite broadcast from GPS satellite broadcast system **140**.

Upon initiation of the secondary communication mode, the telematics device is operated within the secondary communication mode. The secondary communication mode allows communication between a telematics unit within one mobile vehicle, over short distances and utilizing significantly less power, with other telematics units within mobile vehicles equipped with similar capabilities.

In one embodiment, communication between a telematics unit within mobile vehicle **211** utilizing a secondary communications mode includes communicating data to wireless carrier system **240** via a telematics unit within mobile vehicle **210** that is within MVCS **200**. In another embodiment, communication between telematics units within mobile vehicle **211** utilizing a secondary communications mode includes receiving data from wireless carrier system **240** via a telematics unit within mobile vehicle **210** that is within MVCS **200**. In yet another embodiment, data communicated or received includes error messages, emergency messages, and the like. In another embodiment, the secondary communication mode is utilized to establish communication for distribution of standard messages.

FIG. 3 is a flow diagram depicting an exemplary embodiment of a method of operating a degraded vehicle communication unit. In **FIG. 3**, method **300** may utilize one or more systems detailed in **FIGS. 1** and **2** above. The present invention can also take the form of a computer usable medium including a program for configuring an electronic module within a vehicle. The program stored in the computer usable medium comprises computer program code for executing the method steps described in **FIG. 3**.

In **FIG. 3**, method **300** begins at block **310**. At block **320**, a primary communication mode failure is determined. In one embodiment, the primary communication mode failure is determined by detecting whether the telematics unit can initiate contact with a wireless carrier system. In this embodiment, the primary communication mode failure is also determined if the telematics unit can not maintain communication with the wireless carrier system.

In an example and referring to **FIG. 2** above, the primary communication mode failure is determined by detecting if the telematics unit within mobile vehicle **211** can not initiate contact with wireless carrier system **240**. In this example, the primary communication mode failure is also determined if the telematics unit within mobile vehicle **211** cannot maintain communication with the wireless carrier system **240**. In the above example, detecting whether the telematics unit can initiate contact with a wireless carrier system includes determining the telematics unit is not equipped or designed to operate in the primary communication mode.

In another embodiment, the primary communication mode failure is determined by determining a GPS unit within the vehicle communication unit is unable to receive a GPS satellite broadcast from a GPS satellite broadcast system. In an example and referring to **FIG. 2** above, the primary communication mode failure is determined by detecting if the GPS unit within mobile vehicle **211** can not receive a GPS satellite broadcast from a GPS satellite broadcast system **140**.

At block **330**, a secondary communication mode is initiated responsive to the primary communication mode failure determination. In one embodiment, the secondary communication mode is a short range wireless technology. In an example, the short range wireless technology is Bluetooth standard as described in **FIG. 2**, above. In another embodiment, the secondary communication mode is a wireless networking technology. In an example, the wireless networking technology is IEEE 802.11 series standard as described in **FIG. 2**, above.

At block **340**, the telematics device operates in the secondary communication mode. In one embodiment, operating the telematics device in the secondary communication mode includes communicating data to a wireless carrier system via a second mobile vehicle within the wireless carrier system. In an example and referring to **FIG. 2** above, operating the telematics device in the secondary communication mode within mobile vehicle **211** includes communicating data to wireless carrier system **270** via mobile vehicle **210** that is a node within MVCS **200**.

In another embodiment, operating the telematics device in the secondary communication mode includes receiving data from a wireless carrier system via a second mobile vehicle within the wireless carrier system. In an example and referring to **FIG. 2** above, operating the telematics device in the secondary communication mode within mobile vehicle **211** includes receiving data from MVCS **200** via mobile vehicle **210** that is a node within MVCS **200**.

At block **350**, the method ends.

The above-described methods and implementation for operating a degraded vehicle communication unit within a mobile vehicle communication system (MVCS) are example methods and implementations. These methods and implementations illustrate one possible approach for operating a degraded vehicle communication unit within a mobile vehicle communication system (MVCS). The actual implementation may vary from the method discussed.

Moreover, various other improvements and modifications to this invention may occur to those skilled in the art, and those improvements and modifications will fall within the scope of this invention as set forth in the claims below.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive.